

Appl. No. 09/834,413
Response Dated 12/02/2005
Reply to Office communication of 09/06/2005

DEC 02 2005

Amendments to the Specification:

Please replace the paragraph beginning at page 21, line 18 and ending at page 22, line 3 with the following amended paragraph:

As shown in Figure 1, the precision appliance service center 26 includes a central server 32, an archwire manufacturing system 34 and a bracket placement manufacturing system 36. These details are not particularly important to the scanning system 12 per se and are ~~therefor~~ therefore omitted from the present discussion for sake of brevity. For more details on these aspects of the illustrated orthodontic care system, the interested reader is directed to the patent application of Rüdger Rubbert et al., filed on the same date as the instant application, entitled INTERACTIVE AND ARCHWIRE-BASED ORTHODONTIC CARE SYSTEM BASED ON INTRA-ORAL SCANNING OF TEETH, serial no. 09/835,039, now issued as US Pat. 6,648,640,

~~_____~~, attorney docket no. 01-103, the contents of which are
incorporated by reference herein.

Please replace the paragraph beginning at page 22, line 11 and ending at page 22, line 23 with the following amended paragraph:

The scanner 14 includes a projection system 46 that projects a pattern onto the object 40 along a first projection axis 48. The projected pattern is formed on a slide 50 which is placed in front of a light source 53. In the illustrated embodiment, the light source 53 comprises the terminus of a fiber-optic cable 51. The cable 51 carries a high intensity

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flash generated by a flash lamp 52 located in a base unit 54 for the scanner. A suitable flash lamp is the model FX- 1160 flash unit available from Perkin Elmer. The illuminations of the flash lamp 52 cause the pattern contained in the slide 50 to be projected onto the three-dimensional surface of the object. Further details on the types of patterns suitable for the pattern are set forth in the following co-pending patent applications of Rüdger Rubbert et al.; serial no. 09/254,755 filed March [[9]] 8, 1999; now abandoned, serial no. 09/560,131 filed April 28, 2000, now issued as US Pat. 6,744,914, and serial no. ~~09/673,863~~ 09/673,963 filed November 30, 2000, now issued as US Pat. 6,495,848, assigned to the assignee of the present invention, the contents of which are incorporated by reference herein. A presently preferred projection pattern is described below. The details on the optics of the projection system 46 are set forth in further detail below.

Please replace the paragraph beginning at page 31, line 11 and ending at page 31, line 18 with the following amended paragraph:

As the scanner is moved over the dentition, the imaging device acquires a series of bitmap images. The acquired bitmaps are analyzed using pattern recognition. Pattern recognition detects the median lines of the projected lines, endpoints of the lines and the centers of the colored dots. Other types of patterns are of course possible, such as using triangles, squares, or other coding features. The coding is in the vertical direction (in the direction of the parallel lines), since the distortion of the projection pattern provided by

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the surface of the object is in this direction, as explained more fully in the Rubbert et al. patent application serial no. 09/560,131 filed April 28, 2000, now issued as US Pat. 6,744,914, incorporated by reference herein.

Please replace the paragraph beginning at page 34, line 14 and ending at page 35, line 2 with the following amended paragraph:

In the illustrated embodiment, the separation distance between the light source and the projection pattern is not known or needed, nor is the angle between the axes 48 and 58. However, some non-zero angle between the axes is required in order to obtain depth information. The angle selected will depend on the type of surface or object the scanner will be used for. These types of implementation details will vary considerably depending on the application. Furthermore, it is possible to make the two axes 48 and 58 completely independent of each other by locating the projection and imaging in separate, independently moveable devices. This is described in more detail in the patent application of Rüdger Rubbert et al, serial no. 09/254,843, filed 03/11/1999, now issued as US Pat. 6,359,680, the contents of which are incorporated by reference herein. The calibration procedures described herein are of particular advantage when the projection device and the imaging device are in two separate, independently moveable units.

Please replace the paragraph beginning at page 37, line 6 and ending at page 37, line 8 with the following amended paragraph:

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Another challenge is presented by scanning devices like disclosed in PCT/DE97/01797 by Rubbert, US serial no. 09/254,843, filed 03/11/1999, now issued as US Pat. 6,359,680, where imaging device and projection device are not physically connected to each other, and therefore the geometrical relationship may be completely unknown.

Please replace the paragraph beginning at page 95, line 2 and ending at page 95, line 8 with the following amended paragraph:

The virtual model of the patient's dentition, and the individual tooth objects created as explained above, provide a base for diagnostic analysis of the dentition and treatment planning. Treatment planning is not particularly relevant to the scanning and calibration inventions provided herein, and so only an introduction will be given here. For further details, refer to the application of Rüdger Rubbert et al. filed contemporaneously, ~~serial~~ ~~no.~~ no. _____, entitled INTERACTIVE AND ARCHWIRE-BASED ORTHODONTIC CARE SYSTEM BASED ON INTRA-ORAL SCANNING OF TEETH, serial no. 09/835,039, now issued as US Pat. 6,648,640.
[[_____.]]

Please replace the paragraph beginning at page 102, line 11 and ending at page 102, line 20 with the following amended paragraph:

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The workstation memory also preferably comprises data storage regions storing a plurality of virtual, three-dimensional template orthodontic brackets, shown in Figures 61 and 63. The workstation further comprises software for permitting a user to place one of the virtual, three-dimensional template orthodontic brackets onto the surface of the individual, virtual three-dimensional tooth model and display the placed template bracket on the individual, virtual three-dimensional tooth model. This may be accomplished via the landmarking technique shown in Figure 57, or with object navigation tooth described in more detail in the co-pending application of Rudger Rubbert et al., filed contemporaneously herewith, entitled ORTHODONTIC TREATMENT PLANNING WITH USER-SPECIFIED SIMULATION OF TOOTH MOVEMENT, serial no. 09/834,412, now issued as US Pat. 6,632,089. [[_____ .]]